

CENTRAL ARIZONA PROJECT FISH MONITORING

FINAL REPORT

SUMMARY OF SAMPLE YEAR 2005 FISH SURVEYS IN BEHALF OF A
LONG-TERM MONITORING PLAN FOR FISH POPULATIONS IN
SELECTED WATERS OF THE GILA RIVER BASIN, ARIZONA

by

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This report summarizes fish sampling by Arizona Game and Fish Department (AZGFD), Arizona State University (ASU), and U.S. Bureau of Reclamation (USBR) in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year (SY) 2005 (period October 4, 2005 to March 13, 2006). Protocols implemented during this monitoring are detailed by Clarkson 1996 a-c.

Waters (stations) sampled during this monitoring were (1) San Pedro River (SanP) downstream from the U.S. and Mexico international boundary, (2) Gila River between Coolidge Dam and Ashurst-Hayden Diversion, (3) Salt River between Stewart Mountain Dam and Granite Reef Diversion, (4) Central Arizona Project (CAP) Canal at selected pump plants, (5) Salt River Project (SRP) South Canal (SRPs), (6) SRP Arizona (North) Canal (SRPn), and (7) Florence-Casa Grande (FCG) Canal (Table 1).

Comparisons are not made herein with monitoring data acquired during prior years as reported by Clarkson (1998) and Marsh (1999, 2004a), or to earlier years (e.g., Marsh and Minckley 1982, Mueller 1996). The reader is referred to those documents for comparisons with prior years.

MONITORING OVERVIEW

A total of 24 taxa (excluding undetermined and hybrid *Lepomis* and undifferentiated cichlids) was captured during SY 2005 monitoring. Six species were taken in FCG, 8 in Salt River, 9 in Gila and San Pedro rivers, 11 in CAP, 12 in SRPn, and 15 were taken in SRPs (Table 2). Four native species (17% of total taxa) were collected: longfin dace, roundtail chub, Sonora sucker, and desert sucker. Three were in SRPs, two in San Pedro River and SRPn, one in Salt River, and none was in Gila River, CAP, or FCG canals. Natives comprised 13 to 22% of all species among stations, excepting sample streams where there were none. The remaining 20 taxa were non-native, which among streams numbered between six (FCG) and 12 (SRPs) species.

Bigmouth buffalofish (*Catostomidae: Ictiobus cyprinellus*) is reported for the second consecutive year from a CAP monitoring program station (see Marsh & Kesner 2005). A single specimen was taken from below the electrical fish barrier on the SRP South Canal during SY 2005. The fish was tentatively identified in the field, and photographed, but was not retained as a voucher. The species was introduced to the Salt River in 1918 along with black buffalofish *I. niger* and smallmouth buffalofish *I. bubalis* (Minckley 1973), and members of the genus still occur in reservoirs upstream from the Salt River Project canal system. A single black buffalofish was taken from above the electrical fish barrier on SRPn in 2000 (Marsh 2004b), which represented the first record for the CAP program.

Total number of fish varied widely among streams, reaches, and stations (Table 3), a reflection of differences in sampling effort and gear type as well as fish

abundance. Canal samples were not strictly comparable because those from SRPn, SRPs, and FCG were opportunistic and qualitative (except for samples above the electrical fish barriers on the SRP canals, which represented near-complete censuses). Monitoring in streams and rivers, and in the CAP Canal, is mostly quantitative, supplemented by some non-quantitative sampling. Numbers presented in all text tables include both quantitative and non-quantitative sampling data, and Appendix A provides non-quantitative fish data for samples from the three rivers and CAP canal, from which quantitative data typically are acquired.

Native fishes overall accounted for 10.1% of 3,183 individuals captured at all Gila River basin stations during the sample year (Table 3). Proportion that native fishes comprised of total catch ranged from 0% (Gila River, CAP and FCG canals) to 27.1% (San Pedro). Salt was 22.4% native. SRPs and SRPn samples were 21.9 and 9.9% natives above the electric fish barriers, respectively, and 21.7 and 2.4% natives below those structures (Table 3).

Community structure differed substantially among streams, reaches, and stations (Table 3). Mosquitofish was the most abundant species in combined samples from the San Pedro River (followed by native longfin dace). Red shiner followed by mosquitofish was the most abundant species from samples in the Gila River. Largemouth bass predominated the Salt River catch (followed by native Sonora sucker). Largemouth bass followed by redear sunfish were the most abundant fishes in the CAP Canal. Cichlids and channel catfish predominated in samples above the electrical fish barrier in SRPs and SRPn respectively, followed by Sonora sucker and flathead catfish, respectively, while channel catfish was the most abundant species below the SRPs barrier. Largemouth bass and bluegill sunfish predominated the catch below the barrier on SRPn (84% of the catch). Yellow bullhead predominated the catch above the barrier in FCG (followed by channel catfish), while red shiner was the most abundant species below the barrier (followed by mosquitofish, Table 3).

SAN PEDRO RIVER

Sampling Notes and Deviations from Protocol – The majority of sampling was performed on October 4 and 5, 2005 (Table 1), but station 1-3-3 near the confluence with the Gila River was sampled later, on November 29. Eight of nine currently available stations were sampled. No sample was taken at station 1-2-2 (Soza Ranch) because access was denied. This station has now been removed from the monitoring plan. Station 1-2-3 (Three Links Farm) has been added to the protocol (station designation 1-2-3 was used previously for a different location, which has since been removed from the monitoring protocol). This new station occurs upstream of station 1-2-1 (Hughes Ranch). Backpack electrofishing was conducted at 6 sites, and seines were used to collect fishes at three stations; both being used at the station furthest upstream (1-1-1, Hereford).

Species Richness and Distribution – Nine species were captured in the San Pedro River (Tables 4 and 5A). Goldfish was collected at station 1-3-1 (Aravaipa Creek), which represents the first record of this species from the San Pedro River basin. Six species were taken in the upper reach, three in the middle, and five in the lower. Two natives were encountered (longfin dace and desert sucker), comprising two-ninths of total species. Longfin dace was found at five stations and had the broadest representation among native species, and desert sucker was captured at one station in the upper reach.

Four non-natives were in the upper reach, two in the middle, and four in the lower. Common carp, green sunfish, and fathead minnow were only found in the upper reach, goldfish and red shiner only in the lower, and mosquitofish in the middle and lower reaches. Black bullhead was the only non-native captured in all three reaches.

Assemblage Structure – Non-natives outnumbered natives overall (72.9% of a total catch of 328 individuals), and at upper and lower (but not middle) reaches (Tables 3 and 5A). Native longfin dace was the second most abundant fish species overall (27% of total numbers), predominated the catch in the middle reach (93% of catch), and was the second most abundant species in the upper reach (Table 5A). Two desert suckers were captured at one station in the upper reach.

Mosquitofish was the most abundant non-native and the most abundant species overall, making up 44% of the catch. Red shiner contributed 17% of the total catch, and black bullhead was the third most abundant non-native with 8% of the catch. Other species contributed less than 3% to the total catch.

GILA RIVER

Sampling Notes and Deviations from Protocol – Sampling was performed on November 28 and 29, 2005 (Table 1). Collections were made by AZGFD. Eight of eleven currently available stations were sampled. No stations were sampled in the upper reach because “weather and other high profile projects (topminnow and pupfish stockings) delayed the surveys on the upper two sites on the Gila River” (AZGFD, Pers. Comm.), and A-Diamond Ranch (2-4-1) was not sampled because the landowner could not be contacted. Backpack electrofishing was used at all sites.

Species Richness and Distribution – Nine fish species were captured in the Gila River (Tables 4 and 5B). No new species were detected. Eight were taken in the upper-middle, four in the lower-middle, and four in the lower reach. No natives were encountered. This is the third year in a row where no natives were taken in the Gila River. Longfin dace was last collected in 2001 and Sonora sucker in 2002 (Marsh 2004 c, d).

Red shiner and green sunfish were found in all reaches, were only absent from collections for one station, and were the most widely distributed non-native species. Mosquitofish, channel catfish, and yellow bullhead were captured in two reaches while common carp, bluegill sunfish, largemouth bass, and flathead catfish were only captured in the upper-middle reach.

Assemblage Structure – Non-native red shiner was by far the most abundant species overall (57% of total catch) mainly due to the catch at two upper-middle stations where they predominated (281 individuals out of 329 combined total catch for the two stations). Mosquitofish was second in overall abundance (22% of total numbers) and was predominant in the two lower-middle reach stations. Yellow bullhead was third with 14% of the total catch and was the most abundant species caught in the two lower reach stations. Green sunfish catch was spread out among the stations where it occurred with an overall catch of 3.5%. Other species each contributed less than 3% of the total catch.

SALT RIVER

Sampling Notes and Deviations from Protocol – Sampling was performed on February 9 and 27, and March 13, 2006 (Table 1). All stations were sampled using a boat-mounted electrofisher.

Species Richness and Distribution – Eight fish species were taken from the Salt River; six from the upper, five from the middle and three from the lower station (Table 4 and 5C). Sonora sucker was the only native species taken (13% of species). Only bluegill and largemouth bass were collected at all three stations. Native Sonora sucker and common carp were collected from two stations. Yellow bullhead and mosquitofish were only encountered at the upper station. Flathead catfish was collected at the middle station, and green sunfish at the lower station.

Assemblage Structure – Total catch from the Salt River was 143 individuals. Native fishes (Sonora sucker) comprised 22% of the total catch (Tables 3 and 5C). This is the second consecutive year that native longfin dace and desert sucker were not collected.

Largemouth bass was the most abundant species captured overall (44%), and the most abundant species at all three stations. Common carp was third (13%), followed by yellow bullhead (11%) and bluegill (6%). Other species each made up less than 2% of the total catch.

CENTRAL ARIZONA PROJECT CANAL

Sampling Notes and Deviations from Protocol – The four stations downstream from Phoenix were sampled between October 24 and 27, 2005 (Table 1). No sampling was performed upstream of Phoenix due to the lack of a low flow period

(no outage) during the sample year. Boat-mounted electrofishing, minnow trapping, trammel netting, and trot lining were conducted at all stations sampled.

Species Richness and Distribution – Eleven taxa (exclusive of undetermined or hybrid *Lepomis*), all non-native, were captured from the CAP Canal. No new species were detected. Seven were in the middle (one station), and ten were in the lower reach (Tables 4 and 5D). Grass carp, common carp, red shiner, channel catfish, largemouth bass and striped bass were taken from both reaches. No species was found at all stations, although redear sunfish, grass carp, common carp and largemouth bass were at three of the four stations sampled.

Assemblage Structure – Largemouth bass was the most abundant species overall (19% of total catch), closely followed by redear sunfish (18%) and bluegill (17%) in the sample of 156 individuals from the CAP Canal (Table 5D). This represents a 93% reduction in total catch compared to the previous catch of 2,119 fish in 2004. However, 90% (1,917 fish) of the catch in 2004 was collected in the upper reach, which was not sampled in 2005. And, that 2004 sample was acquired during a drawdown when fish in the Bouse forebay were concentrated and especially vulnerable to electrofishing, so year-to-year results are not strictly comparable. Fourth most abundant was grass carp (12%), followed by red shiner and channel catfish (about 8% each), striped bass (6%), and common carp and black bullhead (about 5% each). Two smallmouth bass and a single threadfin shad were also captured.

Red shiner (12 fish) was the most abundant species in the one-station middle reach, channel catfish was second (8 fish), followed by grass carp and striped bass (6 fish), largemouth bass (5 fish), common carp (3 fish), smallmouth bass (2 fish), and a single unidentified sunfish.

Redear sunfish was the most abundant species in the lower reach (25%) closely followed by bluegill (24%) and largemouth bass (21%). Carp (3 fish) were the most abundant at Brady (4-3-1) where only 5 fish were captured. Bluegill (14 fish) predominated at Red Rock (4-3-2) followed by redear sunfish (11 fish), while at San Xavier (4-3-3) largemouth bass was the most abundant (17 fish) followed by redear sunfish (16 fish).

SRP SOUTH CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed on November 19 and 21, 2005 (Table 1). Five stations were sampled during routine monitoring; one above the electrical fish barrier and four downstream at just below fish barrier (0.1 miles below the barrier), River Road Siphon (2.5 miles), RWCD turnout (4.0 miles), and Triple Junction (9.0 miles) where the South Canal ends. The above and just below barrier sites and the RWCD turnout were sampled with a bag seine (dip nets were used in addition just below the barrier

and at the RWCD turnout), River Road Siphon was sampled by experimental gill net and trammel net, and Triple Junction was sampled using dip nets. We also inspected the plunge pool below the “Falls,” located immediately downstream from the Demossing Station at mile 6.1. Locked gates across canal roadways continue to cause short delays and inconveniences, but these were minor.

Species Richness and Distribution – Fifteen species, including redbelly tilapia (but excluding undetermined cichlids) and three natives, were captured from the SRPs Canal (Tables 2 and 4). No new species were detected. The canal was subdivided into two reaches: “above barrier” (one station), and a downstream, below barrier reach with four stations (Tables 4 and 5E) although these latter reaches were not designated in the monitoring protocol (Clarkson 1996a). Ten species were taken above the electric fish barrier and 13 were from collective downstream canal stations. Native roundtail chub, Sonora sucker, and desert sucker, plus non-native channel catfish, bluegill, largemouth bass, and flathead catfish were encountered above and below the electrical fish barrier. Common carp, smallmouth bass, and undetermined tilapia (including numerous *aurea*-type individuals) were encountered above but not below, while grass carp, red shiner, mosquitofish, bigmouth buffalo, striped bass, and redbelly tilapia were encountered below but not above the barrier.

Below the fish barrier, eleven species were at the upper, two at the upper-middle, five at the lower-middle, and seven at the lower station. Non-native flathead catfish had the widest distribution of all species and was contacted at all five stations.

Assemblage Structure – Native fishes comprised 21.7% of the total catch of 720 individuals from SRPs Canal (Table 3). Sonora sucker was the second most abundant species (Table 5E), and contributed 18.9% to the total, while desert sucker comprised 1.7%. Relative abundance of the native sucker almost certainly was a gross underestimate, as collectors tend to capture sub-samples of up to a few hundred individuals rather than all of the obviously large aggregations that are encountered throughout the canal.

Non-native channel catfish was the most abundant fish overall (Tables 3 and 5E), accounting for 22% of total catch, and followed among non-natives by undetermined cichlids (13%), largemouth bass (10%), red shiner (9%), flathead catfish and grass carp (about 8% each), common carp (4%), and bluegill (2%). Other non-native fishes each contributed less than 1% to the total catch.

Predominant fishes above the electrical fish barrier were undetermined cichlids (31%), native Sonora sucker (19%), channel catfish (18%), flathead catfish (14%), common carp (10%), largemouth bass (3%), and bluegill (2%, Table 5E). Other species each contributed less than 1% to the total catch above the barrier.

Below the fish barrier, channel catfish was the most abundant species captured in combined catch (26%), followed by native Sonora sucker (19%), red shiner (16%), largemouth bass (15%), grass carp (13%), flathead catfish (4%), bluegill, striped bass and native desert sucker (about 2% each). Other species each contributed less than 1% to the total catch below the barrier (Table 5E). The only other species capture was a single specimen of flathead catfish. At the lowermost station where only 28 fish were captured, non-native channel catfish and flathead catfish were the most abundant (46% and 25% respectively).

SRP NORTH (ARIZONA) CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed on January 9 and 12, 2006 (Table 1). Two stations were sampled during routine monitoring: one above the electrical fish barrier and one in the reach extending from Indian Bend Wash (14.5 miles below the barrier) upstream to the 101-Pima freeway overpass. The above barrier site was sampled with a bag seine after partial drainage and a boat-mounted electrofisher and minnow traps were used to collect fishes at Indian Bend Wash. No other stations were sampled due to high flows (no outage).

Species Richness and Distribution – Twelve species including undetermined cichlids were captured from the SRPn Canal (Tables 2 and 4). No new species were detected. Two native species were encountered. The canal was subdivided for into two reaches: “above” (one station) and “below” (one station) the electrical fish barrier (Tables 5F), although these reaches were not designated in the monitoring protocol (Clarkson 1996a). Eleven species were taken above the electric fish barrier and six were collected from below. Native Sonora sucker, channel catfish, bluegill, largemouth bass, and flathead catfish were collected both above and below the barrier. Common carp, red shiner, smallmouth bass, desert sucker, yellow bass, and undetermined cichlids were encountered above but not below the barrier, while green sunfish was taken below but not above.

Assemblage Structure – Native fishes collectively comprised 8.7% of the total number of 506 individuals taken from the SRPn Canal (Table 3). Sonora sucker was the fourth most abundant fish species overall (8% of total catch), while only two desert suckers were encountered (0.4% of total numbers). As in the SRPs canal (above), relative abundances of the two native suckers likely were underestimated.

Non-native channel catfish was the most abundant species overall (31% of total numbers), followed among non-natives by flathead catfish (28%), largemouth bass (16%), bluegill (7%), undetermined tilapia and common carp (about 3% each). Other species each contributed 2% or less to the total numbers.

Above the fish barrier the catch was dominated by the two catfish species; channel catfish (37% of catch) and flathead catfish (33%). Largemouth bass was the third most abundant species above the barrier (11%), followed by Sonora sucker (9%), common carp and undetermined cichlids (4% each). Other species were uncommon-to-rare (Table 5F).

Below the fish barrier, bluegill and largemouth bass were the dominant species (43% and 42% of the total catch respectively), while green sunfish was a distant third (9%). Other species were uncommon-to-rare (Table 5F).

FLORENCE-CASA GRANDE CANAL

Sampling Notes and Deviations from Protocol – Sampling was performed on October 30, 2005 (Table 1). Four stations were sampled during routine monitoring: one immediately below the canal headworks at Ashurst-Hayden Diversion Dam (above the electrical fish barrier located at China Wash), and three below the China Wash barrier located 2.6 miles downstream from the diversion dam. Stations below the barrier were at China Wash, at the first turnout 11.4 miles downstream from Ashurst-Hayden, and at the Pima Lateral Canal (15.2 miles downstream). Three sites were sampled with a straight seine (excluding first turnout site). In addition, a backpack electrofisher was used above the diversion dam and at the first turnout, and dip nets were used at Pima Lateral. Lapses in communication between San Carlos Irrigation District (SCID) and ASU/BR and last-minute changes in scheduling resulted in confusion regarding timing of changes in canal operations and the need for short response times by this contractor and field crew. This situation was a significant inconvenience and required sampling on a Sunday, but it did not significantly compromise fish monitoring.

Species Richness and Distribution – Six species were taken from the Florence-Casa Grande Canal (Tables 2 and 4); none was native. No new species were detected. All species were above and below the electric fish barrier at China Wash. Red shiner and mosquitofish were captured at all stations and had the widest distribution.

Assemblage Structure – No native species were represented in the total sample of 813 individuals from the FCG Canal (Table 3). Above the electrical fish barrier, the catch was predominated by yellow bullhead (39%) and channel catfish (37%), while red shiner was common (20%). Below the electrical fish barrier, red shiner dominated the catch (76%), followed by mosquitofish (17%) and carp (4%). Other species were uncommon-to-rare above and below the barrier (Table 5G).

RECOMMENDATIONS

Relative to qualitative samples, field crews should enter either "1" or enter a nearest order of magnitude approximation (i.e., 1s, 10, 100s, and 1000s) for the number of individuals of any species encountered but not enumerated. This will help avoid confusion about species presence and abundance at a station. This recommendation was put forward in the last sample year report, but has not yet been implemented.

Continue to work toward improved communication between canal operators (CAWCD, SRP, and SCID) and those coordinating and performing fish monitoring activities so that sampling can coincide closely with scheduled outages.

Continue to explore potential techniques to safely, reliably, and effectively sample fishes from the SRP canal system during periods of normal flow.

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TABLE 1. Station, date, gear type, and lead entity for sampling activities conducted in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, for sample year 2005 (period October 4, 2005 to March 13, 2006). Stations are identified by 3-digit numeric codes that respectively indicate stream name, reach name, (1-up to 4-down-stream), and station name (1-3 for upper, middle, and lower) (see Clarkson 1996 a-c). Where station location and name have changed from Clarkson 1996 a-c, the corrected (new) name is given. Dates are given as month (01-12) day (01-31) and year (02 or 03). Abbreviations as follow: Stations: SRP = Salt River Project, FCG = Florence-Casa Grande Canal, and CAP = Central Arizona Project Canal. Gear names, and acronyms by category are Entrapment/Entanglement: gill net (G), trammel net (T), hoop net (H), fyke net (F), trap net (TR), minnow trap (M), shock/gill net (SGN), shock/trammel net (STN), experimental gill net (EXPG); Seining: straight seine (SS), bag seine (BS), kick seine (KS), dip net (D); Angling: spin-cast (SC), fly rod (FR), drop line (DL), trotline (TL); Electrofishing: backpack shocker (Bp), boat shocker (Ef), bank shocker (BKS); tote barge shocker (TB); and Miscellaneous: trammel net/drifted (TND), gill net/drifted (GND), and electric seine (ES). CAP stations all are associated with pumping plants, which are named for each station, while FCG and SRP stations are given as approximate miles downstream from canal origin and/or a verbal location description.

Station	Date	Gear	Lead
San Pedro River			
1-1-1 Hereford	10 04 05	Bp, SS	AZGFD
1-1-2 Lewis Springs	10 04 05	Bp	AZGFD
1-1-3 Charleston	10 04 05	Bp	AZGFD
1-2-1 Hughes Ranch	10 05 05	Bp	AZGFD
1-2-2 Soza Ranch	No sample		
1-2-3 Three Links Farm	10 05 05	Bp	AZGFD
1-3-1 Aravaipa Creek	10 05 05	SS	AZGFD
1-3-2 Swingle Wash	10 05 05	SS	AZGFD
1-3-3 Mouth	11 29 05	Bp	AZGFD
Gila River			
2-1-1 Coolidge Dam	No sample		
2-1-3 Hook & Line Ranch	No sample		
2-2-1 Dripping Springs Wash	11 28 05	Bp	AZGFD
2-2-2 Christmas	11 28 05	Bp	AZGFD
2-2-3 O'Carrol Canyon	11 28 05	Bp	AZGFD
2-3-1 San Pedro River	11 29 05	Bp	AZGFD
2-3-2 Kearny	11 29 05	Bp	AZGFD
2-3-3 Kelvin	11 29 05	Bp	AZGFD
2-4-1 A-Diamond Ranch	No sample		
2-4-2 Cochran	11 28 05	Bp	AZGFD
2-4-3 Box-O Wash	11 28 05	Bp	AZGFD

Salt River

3-1-1	Stewart Mountain Dam	02 09 06	Ef	AZGFD
3-1-2	Blue Point RS	02 27 06	Ef	AZGFD
3-1-3	Granite Reef Dam	03 13 06	Ef	AZGFD

CAP Pumping Plants

4-1-1	Bouse	No sample		
4-1-2	Little Harquahala	No sample		
4-1-3	Hassayampa	No sample		
4-2-1	Salt-Gila	10 24 05	Ef, M, T, TI	USBR
4-3-1	Brady	10 27 05	Ef, M, T, TI	USBR
4-3-2	Red Rock	10 26 05	Ef, M, T, TI	USBR
4-3-3	San Xavier	10 25 05	Ef, M, T, TI	USBR

SRP South Canal

5	0.0 Above fish barrier	11 21 05	BS	AZGFD
	0.1 Below fish barrier	11 19 05	BS, D	ASU
	2.5 River Road siphon	11 19 05	G, T	ASU
	4.0 RWCD turnout	11 19 05	BS, D	ASU
	9.0 Triple Junction	11 19 05	D	ASU

SRP North (Arizona) Canal

6	0.0 Above fish barrier	01 09 06	BS	AZGFD
	0.3 Below fish barrier	No sample		
	8.0 Evergreen Drain	No sample		
	14.5 Indian Bend Wash	01 12 06	Ef, M	ASU

FCG

7	0.0 Below diversion dam	10 30 05	Bp, SS	ASU
	2.6 Below China Wash	10 30 05	SS	ASU
	11.4 First turnout	10 30 05	Bp	ASU
	15.2 Pima Lateral	10 30 05	SS, D	ASU

TABLE 2. Common names and four letter codes for fish species captured during sampling activities conducted in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2005 (period October 4, 2005 to March 13, 2006). Native fishes indicated by asterisks. Abbreviations as in Clarkson 1996 a, but also see notes below.

Species		SanP	Gila	Salt	CAP	SRPs	SRPn	FCG	All sites
*Desert sucker	PACL	X	O	O	O	X	X	O	X
*Longfin dace	AGCH	X	O	O	O	O	O	O	X
*Sonora sucker	CAIN	O	O	X	O	X	X	O	X
*Roundtail chub	GIRO	O	O	O	O	X	O	O	X
Bigmouth buffalo	ICCY	O	O	O	O	X	O	O	X
Black bullhead	AMME	X	O	O	X	O	O	O	X
Bluegill	LEMA	O	X	X	X	X	X	O	X
Channel catfish	ICPU	O	X	O	X	X	X	X	X
Common carp	CYCA	X	X	X	X	X	X	X	X
Fathead minnow	PIPR	X	O	O	O	O	O	O	X
Flathead catfish	PYOL	O	X	X	O	X	X	O	X
Goldfish	CAAU	X	O	O	O	O	O	O	X
Grass carp	CTID	O	O	O	X	X	O	O	X
Green sunfish	LECY	X	X	X	O	O	X	X	X
Largemouth bass	MISA	O	X	X	X	X	X	O	X
Mosquitofish	GAAF	X	X	X	O	X	O	X	X
Red shiner	CYLU	X	X	O	X	X	X	X	X
Redbelly tilapia	TIZI	O	O	O	O	X	O	O	X
Redear sunfish	LEMI	O	O	O	X	O	O	O	X
Smallmouth bass	MIDO	O	O	O	X	X	X	O	X
Striped bass	MOSA	O	O	O	X	X	O	O	X
Threadfin shad	DOPE	O	O	O	X	O	O	O	X
Undetermined Cichlid ¹	TILA	O	O	O	O	X	X	O	X
Undetermined or hybrid sunfish ²	LEPO	O	O	O	X	O	O	O	X
Yellow bass	MOMI	O	O	O	O	O	X	O	X
Yellow bullhead	AMNA	O	X	X	O	O	O	X	X

Stream	SanP	Gila	Salt	CAP	SRPs	SRPn	FCG	All sites
Total species (taxa) ³	9	9	8	11	15	12	6	24
Native	2	0	1	0	3	2	0	4
Non-native	7	9	7	11	12	10	6	20
Percent native	22	0	13	0	20	17	0	17

¹ Undetermined Cichlids likely includes juvenile and adult Mozambique tilapia, *Tilapia (Oreochromis) mossambica*, and blue tilapia *Tilapia (Oreochromis) aurea* and their hybrids, plus juvenile redbelly (Zill's) *tilapia, Tilapia zilli*.

² Undetermined or hybrid sunfish may include juveniles of all species of *Lepomis* plus juvenile and adult individuals that represent crosses among the several species of *Lepomis*, which are known to hybridize freely.

³ Total species(taxa) includes undetermined Cichlids (except in cases where Redbelly tilapia and Undetermined Cichlids co-occur in the table), but excludes undetermined or hybrid sunfishes, the latter of which are assumed to be subsumed into the individual parental species.

TABLE 3. Total numbers of fishes captured during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2005 (period October 4, 2005 to March 13, 2006). Native fishes indicated by asterisks. Abbreviations as in Clarkson (1996a). Ab and Bb respectively indicate Above and Below electrical fish barriers on SRPn, SRPs, and FCG canals.

Table 2005-3 Total numbers of fishes

Species	SanP	Gila	Salt	CAP	SRPs		SRPn		FCG		Total
					Ab	Bb	Ab	Bb	Ab	Bb	
*Desert sucker	2	0	0	0	3	9	2	0	0	0	16
*Longfin dace	87	0	0	0	0	0	0	0	0	0	33
*Sonora sucker	0	0	32	0	59	77	40	2	0	0	210
Bigmouth buffalo fish	0	0	0	0	0	1	0	0	0	0	1
Black bullhead	25	0	0	7	0	0	0	0	0	0	31
Bluegill	0	3	9	27	6	10	1	35	0	0	91
Channel catfish	0	11	0	12	56	105	156	3	218	3	564
Common carp	7	4	18	8	30	0	17	0	6	8	98
Fathead minnow	2	0	0	0	0	0	0	0	0	0	2
Flathead catfish	0	2	2	0	42	17	139	1	0	0	203
Goldfish	3	0	0	0	0	0	0	0	0	0	3
Grass carp	0	0	0	18	0	54	0	0	0	0	72
Green sunfish	3	18	2	0	0	0	0	7	5	3	38
Largemouth bass	0	2	63	29	10	60	47	34	0	0	245
Mosquitofish	144	111	1	0	0	1	0	0	13	38	304
Red shiner	55	294	0	13	0	65	1	0	116	174	718
Redbelly tilapia	0	0	0	0	0	2	0	0	0	0	2
Redear sunfish	0	0	0	28	0	0	0	0	0	0	28
Roundtail chub	0	0	0	0	6	3	0	0	0	0	9
Smallmouth bass	0	0	0	2	2	0	2	0	0	0	6
Striped bass	0	0	0	10	0	6	0	0	0	0	16
Threadfin shad	0	0	0	1	0	0	0	0	0	0	1
Undetermined Cichlid	0	0	0	0	96	0	17	0	0	0	113
Undetermined or hybrid sunfish	0	0	0	1	0	0	0	0	0	0	1
Yellow bass	0	0	0	0	0	0	2	0	0	0	2
Yellow bullhead	0	72	16	0	0	0	0	0	226	3	317
Total	328	517	143	156	310	410	424	82	584	229	3183
Total native	89	0	32	0	68	89	42	2	0	0	322
Total nonnative	239	517	111	156	242	321	382	80	584	229	2861
Percent native	27.1	0.0	22.4	0.0	21.9	21.7	9.9	2.4	0.0	0.0	10.1

TABLE 4. Fish species richness determined by sampling in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year (SY) 2005 (period October 4, 2005 to March 13, 2006). Species counts include undetermined Cichlids but exclude undetermined plus hybrid *Lepomis* (see notes accompanying Table 1). See table 1 for reach and station names (see also Clarkson 1996 a-c). Distances between stations and reaches are relative. Totals for each reach (and for all reaches) followed by number of native and non-native (n/nn) species; NS indicates no sample during SY 2005; dash (--) indicates designated reach or station does not exist on that stream/canal. Reaches along SRPn, SRPs, and FCG canals are artificial; canal reaches 1 are above respective electrical fish barriers and reaches 2, 3, and 4 are below; see also Clarkson (1996 a-c).

Reach/Station	SanP	Gila	Salt	CAP	SRPs	SRPn	FCG
1-1	5	NS	6	NS	10	11	6
1-2	2	--	5	NS	--	--	--
1-3	3	NS	3	NS	--	--	--
total	6		8		10	11	6
n/nn	2/4		1/7		2/8	2/9	0/6
2-1	1	5	--	7	11	NS	3
2-2	NS	7	--	--	2	NS	5
2-3	3	4	--	--	5	6	4
2-4	--	--	--	--	7	--	--
total	3	8		7	13	6	6
n/nn	1/2	0/8		0/7	3/10	1/5	0/6
3-1	3	NS	--	3	--	--	--
3-2	4	3	--	7	--	--	--
3-3	1	2	--	6	--	--	--
total	5	4		10			
n/nn	1/4	0/4		0/10			
4-1	--	--	NS	--	--	--	--
4-2	--	--	4	--	--	--	--
4-3	--	--	4	--	--	--	--
total		4					
n/nn		0/4					
all reaches	9	9	8	11	15	12	6
n/nn	2/7	0/9	1/7	0/11	3/12	2/10	0/6
percent native	22	0	13	0	20	17	0

TABLE 5A. Fish catch at San Pedro River stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2005 (period October 4, 2005 to March 13, 2006). Fish species listed alphabetically using standard abbreviations per Clarkson (1996), data are total fish or number of young-of-year (age-0) followed by number of older age classes (age >1), if specified; subtotals and total number are for each age class.

station code	AGCH	AMME		CAAU		CYCA		CYLU	GAAF	LECY		PACL		PIPR	sum	No Spp
		0	1	0	1	0	1			0	1	0	1			
1-1-1	7	7	11				5			2	1			2	35	5
1-1-2			5				1								6	2
1-1-3	12						1					2			15	3
subtotal	19	7	16	0	0	0	7	0	0	2	1	2	0	2	56	6
1-2-1	10														10	1
1-2-3	54		1						4						59	3
subtotal	64	0	1	0	0	0	0	0	4	0	0	0	0	0	69	3
1-3-1						3		4	2						9	3
1-3-2	4		1					47	138						190	4
1-3-3								4							4	1
subtotal	4	0	1	0	3	0	0	55	140	0	0	0	0	0	203	5
Total	87	7	18	0	3	0	7	55	144	2	1	2	0	2	328	9

TABLE 5B. Fish catch at Gila River stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2005 (period October 4, 2005 to March 13, 2006). Fish species listed alphabetically using standard abbreviations per Clarkson (1996); data are total fish or number of young-of-year (age-0) followed by number of older age classes (age >1), if specified; subtotals and total number are for each age class.

station code	AMNA		CYCA		CYLU	GAAF	ICPU		LECY		LEMA		MISA		PYOL		sum	No Spp
	0	1	0	1			0	1	0	1	0	1	0	1	0	1		
2-2-1					130	26			7		2	1					166	5
2-2-2				4	151			1		4	1	1				1	163	7
2-2-3					3	10			1	1						1	16	4
subtotal	0	0	0	4	284	36	0	1	8	5	0	3	2	0	0	2	345	8
2-3-2					2	44			3								49	3
2-3-3	22	1				31											54	2
subtotal	22	1	0	0	2	75	0	0	3	0	0	0	0	0	0	0	103	4
2-4-2	26				7		2		1								36	4
2-4-3	23				1		8		1								33	4
subtotal	49	0	0	0	8	0	10	0	2	0	0	0	0	0	0	0	69	4
Total	71	1	0	4	294	111	10	1	13	5	0	3	2	0	0	2	517	9

TABLE 5C. Fish catch at Salt River stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2005 (period October 4, 2005 to March 13, 2006). Fish species listed alphabetically using standard abbreviations per Clarkson (1996), data are total fish or number of young-of-year (age-0) followed by number of older age classes (age \geq 1), if specified; total number is for each age class.

station code	AMNA		CAIN		CYCA		GAAF	LECY		LEMA		MISA		PYOL		sum	No Spp
	0	1	0	1	0	1		0	1	0	1	0	1	0	1		
3-1-1	2	14	2	20		1	1				2	7	19			68	6
3-1-2			2	8		17					1	9	11		2	50	5
3-1-3								2	1	5	8	9				25	3
Total	2	14	4	28	0	18	1	0	2	1	8	24	39	0	2	143	8

TABLE 5D. Fish catch at Central Arizona Project (CAP) canal stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2005 (period October 4, 2005 to March 13, 2006). Fish species listed alphabetically using standard abbreviations per Clarkson (1996); data are total fish or number of young-of-year (age-0) followed by number of older age classes (age ≥ 1), if specified; subtotals and total number are for each age class.

station code	AMME		CTID		CYCA		CYLU	DOPE	ICPU		LEMA		LEMI		LEPO		MIDO		MISA		MOSA		sum	No Spp
	0	1	0	1	0	1			0	1	0	1	0	1	0	1	0	1	0	1	0	1		
4-2-1				6		3	12		2	6					1		2	1	4	1	5	43	7	
subtotal	0	0	0	6	0	3	12	0	2	6	0	0	0	0	1	0	0	2	1	4	1	5	43	7
4-3-1						3	1						1									5	3	
4-3-2				3		2		1			14	11					5	2	3	1		42	7	
4-3-3		7		9						4	5	8	1	15			6	11				66	6	
subtotal	0	7	0	12	0	5	1	1	0	4	5	22	1	27	0	0	0	0	11	13	3	1	113	10
Total	0	7	0	18	0	8	13	1	2	10	5	22	1	27	1	0	0	2	12	17	4	6	156	11

TABLE 5E. Fish catch at Salt River Project (SRP) South Canal stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2005 (period October 4, 2005 to March 13, 2006). Fish species listed alphabetically using standard abbreviations per Clarkson (1996), data are total fish or number of young-of-year (age-0) followed by number of older age classes (age ≥ 1), if specified; total number is for each age class. See Table 1 for sampling dates.

	CAIN		CTID		CYCA				GIRO		ICCY		ICPU		LEMA		MIDO		MISA		MOSA		PACL		PYOL		TILA		TIZI		sum	No Spp	
	0	1	0	1	0	1	CYLU	GAAF	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1	0	1			
above barrier	33	26				30				6			7	49		6		2		2	8			3		6	36		96			310	10
subtotal	33	26	0	0	0	30	0	0	0	6	0	0	7	49	0	6	0	2		2	8	0	0	3	0	6	36	0	96	0	0	310	10
0.1 below dam		61		53			6			3	1	19	35							4		6		8			4			2	202	11	
2.5 below dam		2																									2				4	2	
4.0 below dam	13	1										2		10													1				81	5	
9.0 below dam				1			59	1				48	1							2			1		10						123	7	
subtotal	13	64	0	54	0	0	65	1	0	3	0	1	69	36	10	0	0	0	0	54	6	0	6	1	8	11	6	0	0	0	2	410	13
Total	46	90	0	54	0	30	65	1	0	9	0	1	76	85	10	6	0	2	56	14	0	6	4	8	17	42	0	96	0	2	720	15	

TABLE 5F. Fish catch at Salt River Project (SRP) North (Arizona) Canal stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2005 (period October 4, 2005 to March 13, 2006). Fish species listed alphabetically using standard abbreviations per Clarkson (1996), data are total fish or number of young-of-year (age-0) followed by number of older age classes (age ≥ 1), if specified; total number is for each age class. See Table 1 for sampling dates.

	CAIN		CYCA			ICPU		LECY		LEMA		MIDO		MISA		PACL		PYOL			MOMI		sum	No Spp
	0	1	0	1	CYLU	0	1	0	1	0	1	0	1	0	1	0	1	0	1	TILA*	0	1		
above barrier	27	13		17	1	56	100				1		2	6	41	2		3	136	17	2		424	11
subtotal	27	13	0	17	1	56	100	0	0	0	1	0	2	6	41	2	0	3	136	17	2	0	424	11
14.5 below dam		2				1	2	7		35				32	2				1				82	6
subtotal	0	2	0	0	0	1	2	7	0	35	0	0	0	32	2	0	0	0	1	0	0		82	6
Total	27	15	0	17	1	57	102	7	0	35	1	0	2	38	43	2	0	3	137	17	2	0	506	12

* No age information is given

TABLE 5G. Fish catch at Florence Casa Grande (FCG) Canal stations (see TABLE 1) during sampling in behalf a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2005 (period October 4, 2005 to March 13, 2006). Fish species listed alphabetically using standard abbreviations per Clarkson (1996), data are total fish or number of young-of-year (age-0) followed by number of older age classes (age ≥ 1), if specified; total number is for each age class. See Table 1 for sampling dates.

	AMNA		CYCA		CYLU	GAAF	ICPU		LECY		sum	No Spp
	0	1	0	1			0	1	0	1		
above barrier	226		6		116	13	218		5		584	6
subtotal	226	0	6	0	116	13	218	0	5	0	584	6
2.6 below dam					128	23			2		153	3
11.4 below dam	3		5		11	7				1	27	5
15.2 below dam				3	35	8	3				49	4
subtotal	3	0	5	3	174	38	3	0	2	1	229	6
Total	229	0	11	3	290	51	221	0	7	1	813	6

Appendix A. Numbers of fishes captured in non-quantitative stream and CAP canal samples in behalf of a long-term monitoring plan for fish populations in selected waters of the Gila River basin, Arizona, during sample year 2005 (period October 4, 2005 to March 13, 2006). Abbreviations as in Clarkson (1996a).

	Gear	Species code	Count	Comment
San Pedro River				
	backpack shocker	AGCH	49	
	straight seine	AGCH	5	
	backpack shocker	AMME	1	
	backpack shocker	GAAF	4	